Dryden Flight Research Center Critical Chain Project Management Implementation

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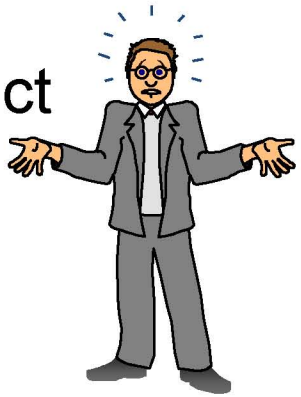
Outline

- The Need for Change at Dryden
- Choosing a solution and first year Results
- How did we do it, what did we change?
- Implementation Challenges
- Next steps and Conclusions

Dryden Work Environment

- Almost equal support of ARMD, SMD, and HEO with growth in Space Technology
- Majority of work occurs at sub-project or task level
- Work content and schedule driven from outside Dryden
- Program demand exceeds FTE center ceiling
- Highly matrixed Center organization
- Limited number of certain skills in key areas such as structures engineering and backshop support
- Multi-project environment causes resource conflict



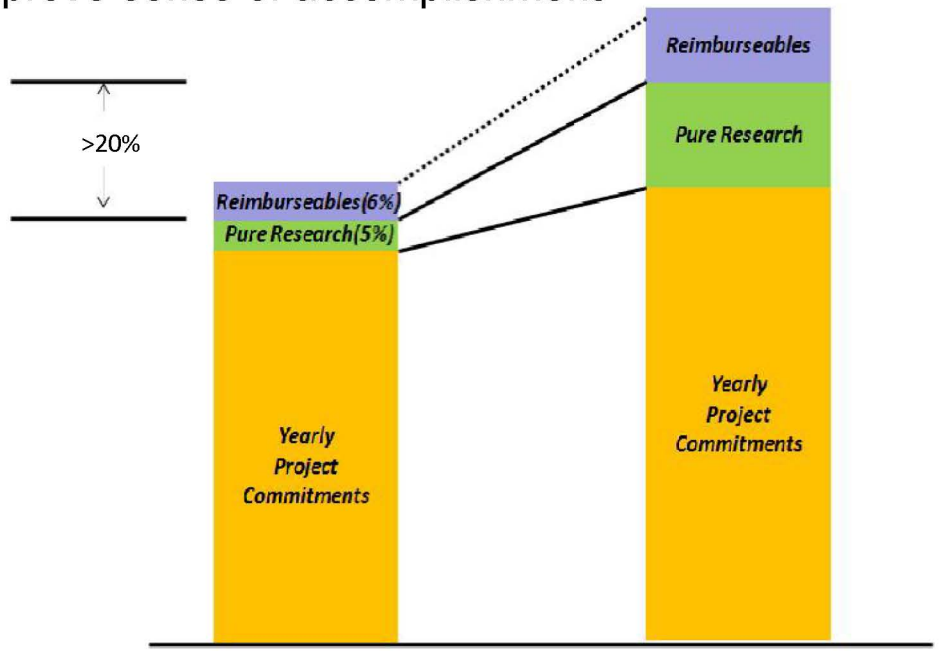
The Need For Change at Dryden

- Recent NASA audits have indicated that our workforce is stressed to keep up with project demand.
  - Many individuals will work on 10 different projects in 1 pay period
- In a Dryden-wide survey, workforce identified improved project planning as the number one area to improve work/life balance
- Need to become more efficient due to a combination of program demand growth and declining budgets

Goals

For Our People

- Reduce stress for people
- Reduce multi-tasking
- Improve prioritization of work
- Improve sense of accomplishment



For Our Business

- Improve on-time performance
- Improve Time for:
  - Training
  - R&D
  - Near Term Opportunities
  - Infrastructure Improvement

Position us for Available Opportunity

Significant productivity gains (>20%) are required to meet these goals

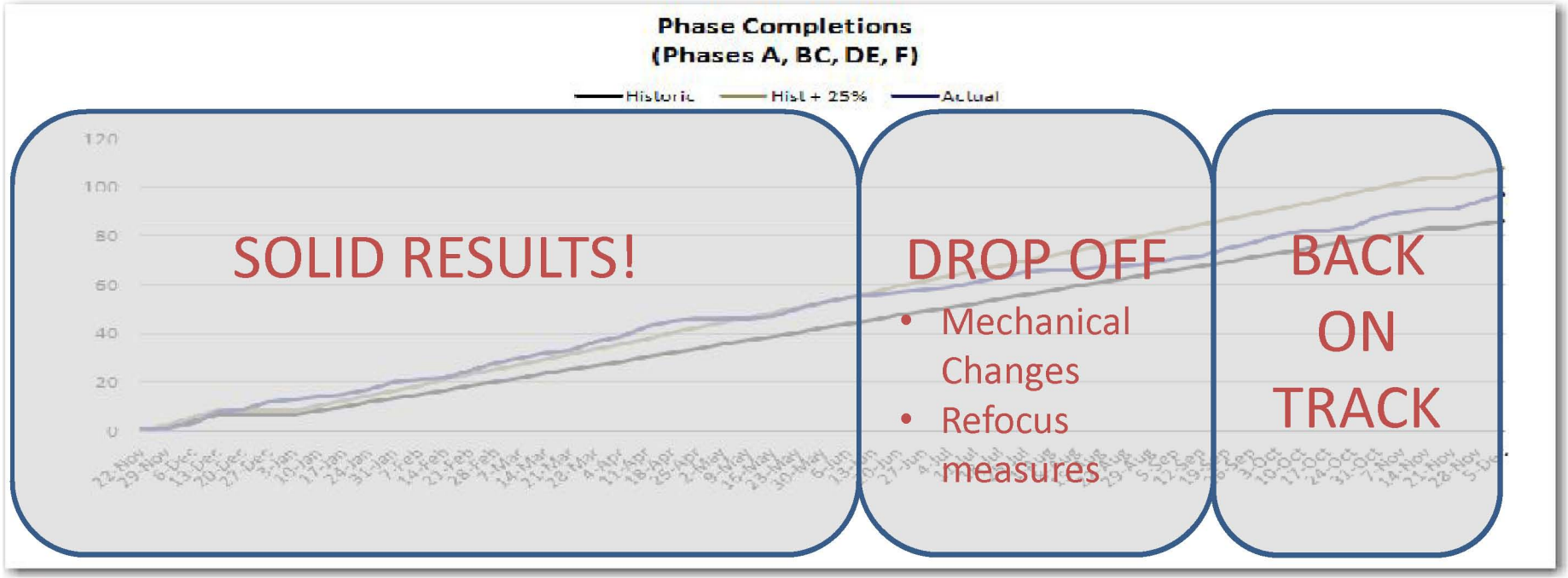
Determining a Solution

Dryden senior management realized that we needed to **change the way we work**

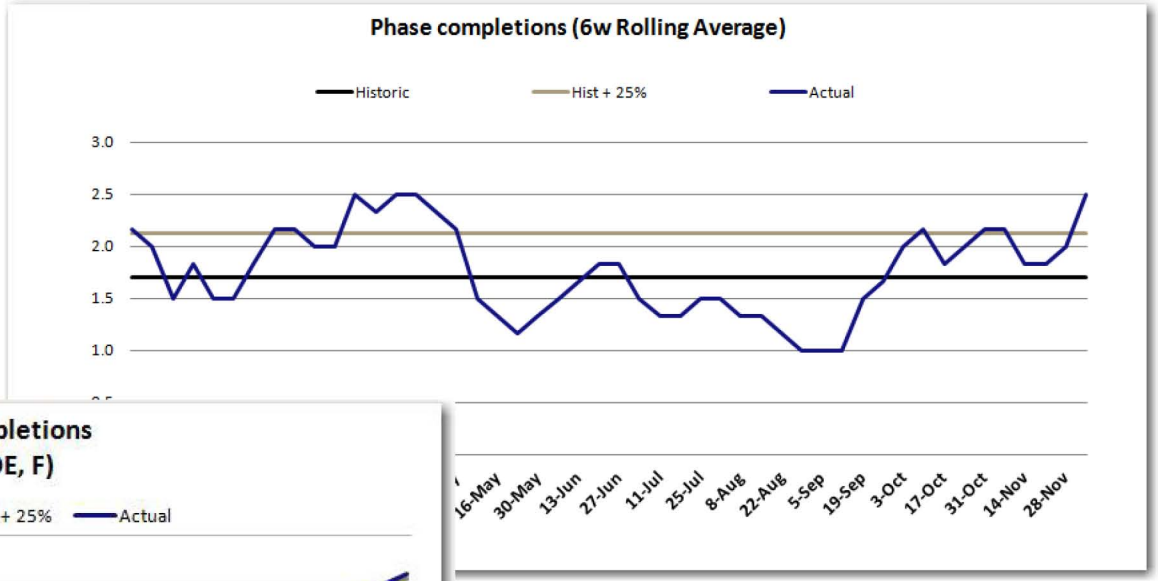
In July 2010, Dryden Management chose to implement CCPM methodology at the start of FY11

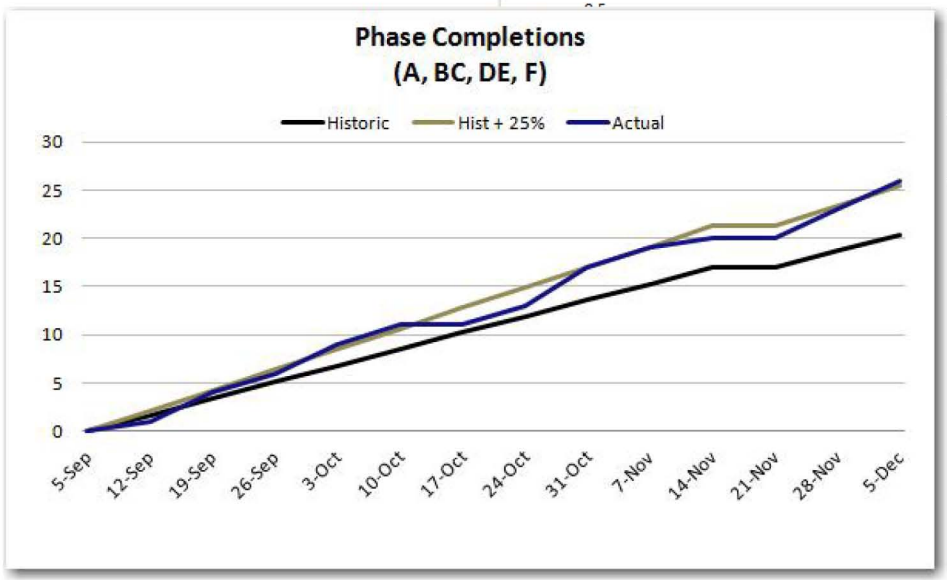
First year results

- 25% increase in work completed for the first 6 months!
- Results declined for a few months as we attacked bottlenecks and thought through mechanical changes
- First QTR FY 2012 we are back on track



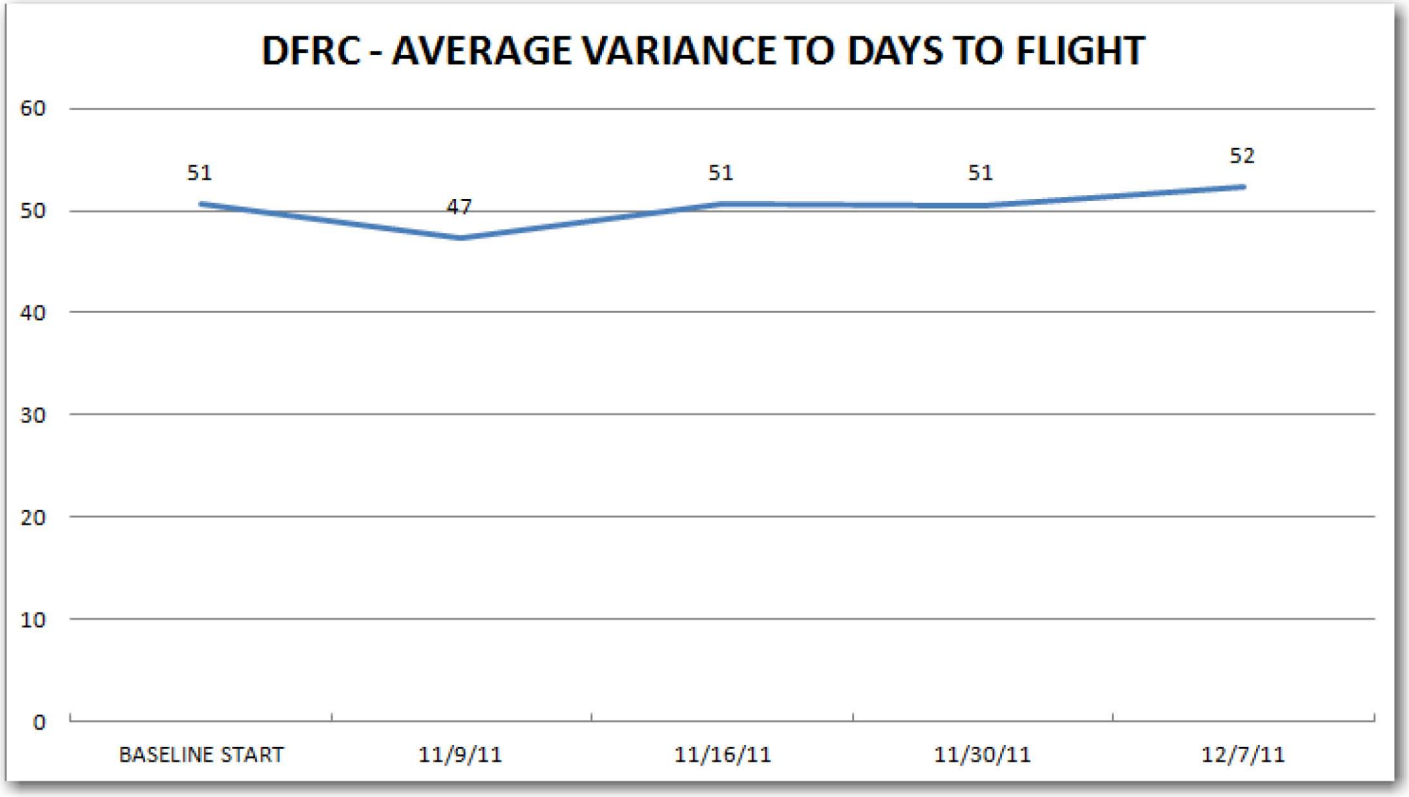
Results – 1st QTR 2012





Variance to original Planned Date (BCD)

- New measure developed to drive the correct behavior
- Goals set to cut the variance in half over the next year



Other Benefits of CCPM

- Increase time employees can spend on research, training, job skill improvement
- Provide a better work environment for DFRC workforce
- Improved visibility into current & projected status of Center project portfolio for management chain
- Ability to project future resource pinch points and monitor corrective actions
- Concerto software that implements CCPM provides the prioritized task list and buffer consumption charts to assist in conflict resolution

How did we do it?

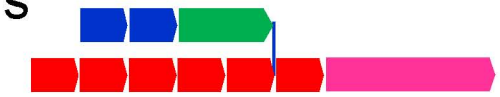
Followed some simple rules based on CCPM concepts…

PIPELINING

- We staggered project starts to reduce WIP for management and support and staggered the due-dates to enable stable priorities for direct resources

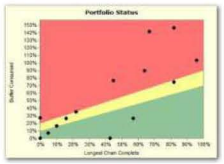
BUFFERING

- Removed measurements based on local efficiency and schedules
- Created aggressive/feasible plans with 1/3rd buffers

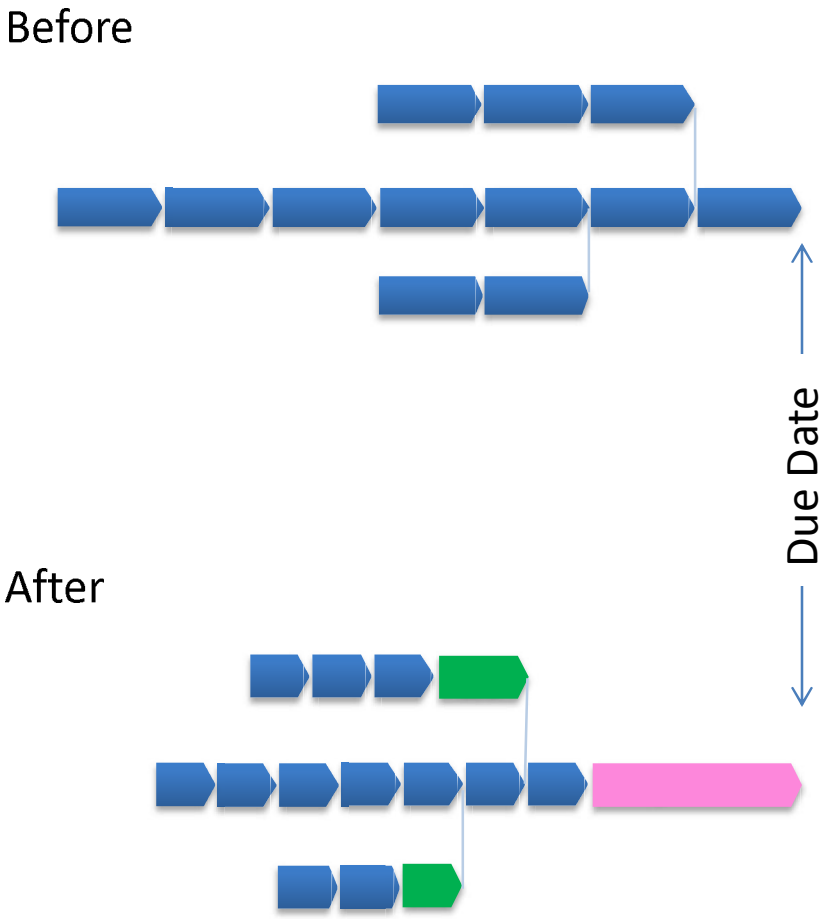


BUFFER MANAGEMENT

- Set priorities based on buffer consumption
- Used buffer consumption for control



Buffers



- Traditional networks have safety embedded in the tasks
- Safety is removed form tasks and moved to the end to be shared by all when needed

How buffer signals drive priorities

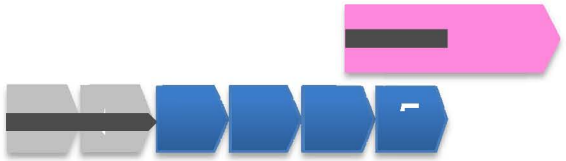
Project 1

Project Completion = 50%

Buffer Consumption = 40%

Priority Index = 0.4/0.5 = 80%

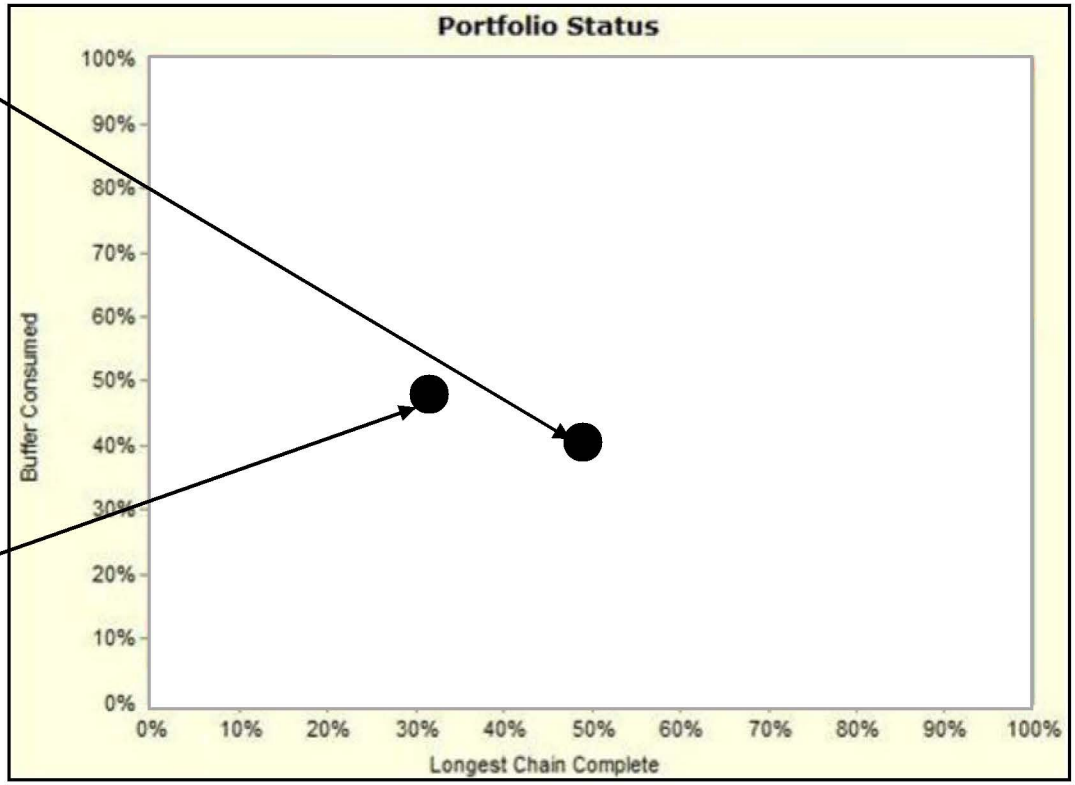
Project 2



Project Completion = 33%

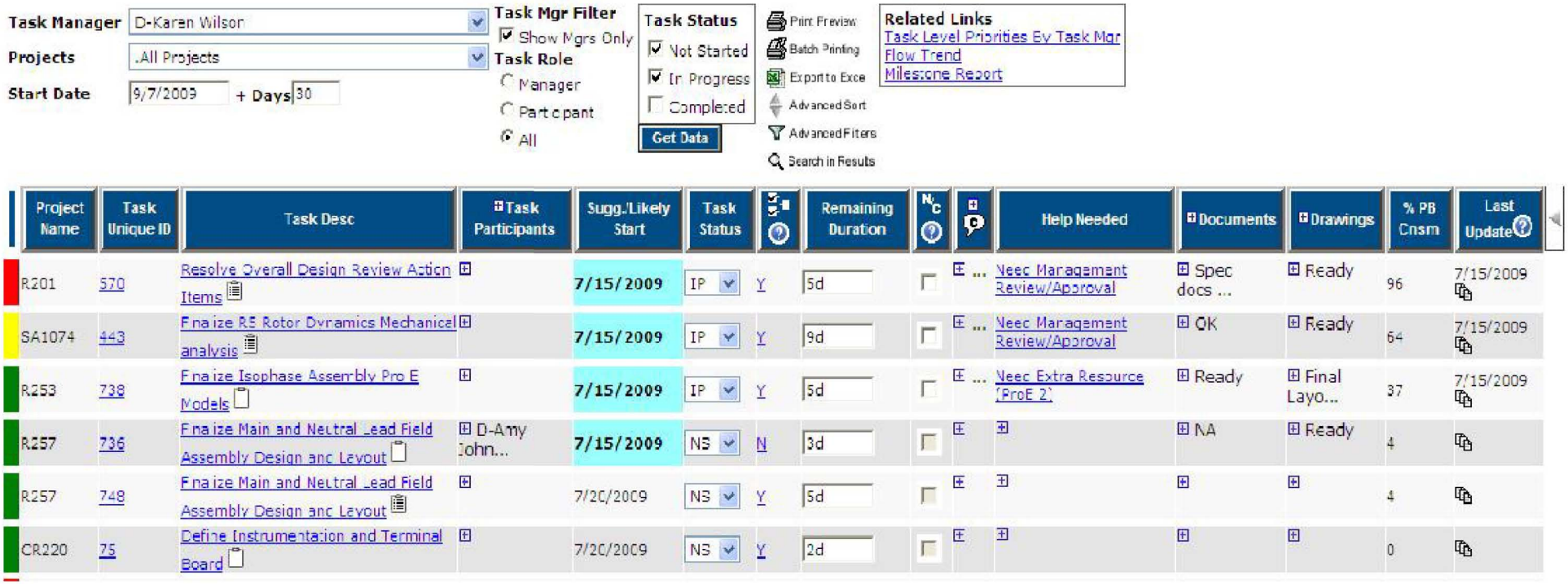
Buffer Consumption = 50%

Priority Index = 0.5/0.33 = 150%



Priorities for resources

Synchronized priorities and sense of urgency
(what to do and how urgently)



Project Name	Task Unique ID	Task Desc	Task Participants	Sugg./Likely Start	Task Status		Remaining Duration			Help Needed	Documents	Drawings	% PB Cnsm	Last Update
R201	570	Resolve Overall Design Review Action Items		7/15/2009	IP	Y	5d			Need Management Review/Approval	Spec docs ...	Ready	96	7/15/2009
SA1074	443	Finalize RE Rotor Dynamics Mechanical analysis		7/15/2009	IP	Y	9d			Need Management Review/Approval	OK	Ready	64	7/15/2009
R253	738	Finalize Isophase Assembly Pro E Models		7/15/2009	IP	Y	5d			Need Extra Resource (ProE 2)	Ready	Final Layo...	37	7/15/2009
R257	736	Finalize Main and Neutral Lead Field Assembly Design and Layout	D-Amy John...	7/15/2009	NS	N	3d				NA	Ready	4	
R257	748	Finalize Main and Neutral Lead Field Assembly Design and Layout		7/20/2009	NS	Y	5d						4	
CR220	75	Define Instrumentation and Terminal Board		7/20/2009	NS	Y	2d						0	

Data is Notional

Priorities for management

Resource managers look to see where tasks are stuck and their urgency

	Project Name	Task Unique ID	Task Desc	Task Mgr	Task Status	Remaining Duration	Help Needed	Last Update
1	R204	569	Conduct Overal Design Review	Paul Young	IP	0.5c		7/15/2009
2	R201	570	Resolve Overall Design Review Action Items	D-Karen Wilson	IP	5d	Need Management Review/Approval	7/15/2009
3	CG251	65	Vent Test Requirements	Louis Kim	NS	2d	Need Requirement Clarification	
4	CS202	41	Top Coil Installation	Louis Kim	IP	15d *	Need Requirement Clarification	7/15/2009
5	CG257	47	EE and TE Subassy Installation	D-Amy Johnson	IP	7d *	Need Extra Resource (Mech Eng 2)	7/15/2009
6	R251	4	Develop Stator Release Schedule	Louis Kim	IP	3d *	Need Management Review/Approval	7/15/2009
7	R202	570	Resolve Overall Design Review Action Items	Louis Kim	IP	5d *	Need Requirement Clarification	7/15/2009
8	SA1074	443	Finalize R5 Rotor Dynamics Mechanical analysis	D-Karen Wilson	IP	9d *	Need Management Review/Approval	7/15/2009

Data is Notional

What did we change?

BEFORE

WORKLOAD

- Projects accepted with no regard for capacity or overloads
- All projects are worked at the same time
- No mechanism to say no or yes to work

PRIORITIES

- Projects fight for resources and the Squeaky wheel gets priority

RESOURCE ALLOCATION

- Resources spread thin over many projects

SOLVING ISSUES

- Issues tackled as they move into crisis mode, managers overloaded with issues

AFTER

WORKLOAD

- Stagger project starts based on capacity
- Limit work in execution… so we can do more
- Test to see if we can accept the work

PRIORITIES

- Synchronize resource needs across all projects in work based on buffer signal

RESOURCE ALLOCATION

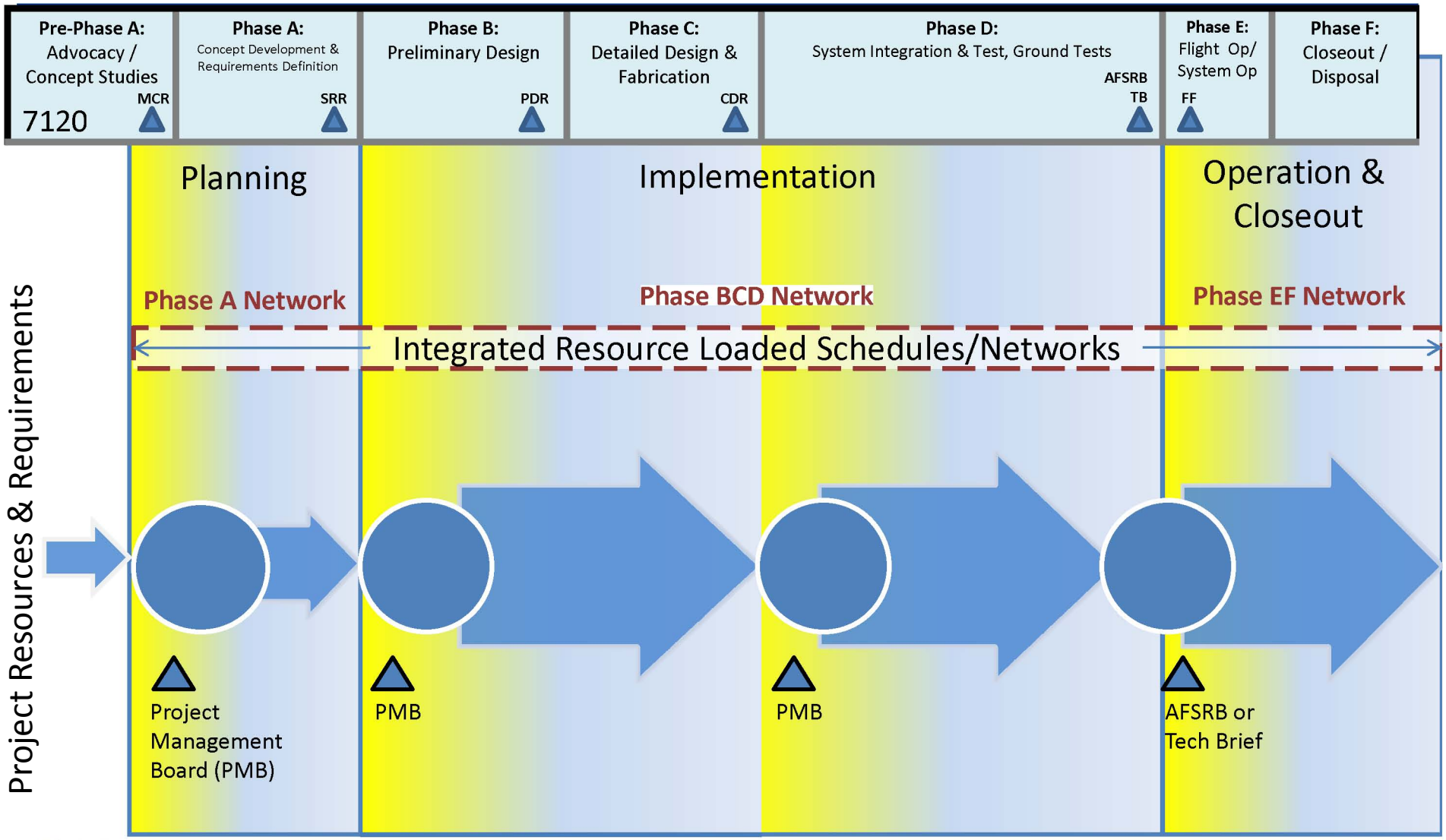
- Resources focused on fewer tasks at a time, allocated to real need

SOLVING ISSUES

- Issues raised and identified early and solved quickly to avoid delays

Project Lifecycle Process

Integration of the lifecycle process of preparing and conducting ARMD research



Implementation Challenges

- Development of project networks that are simple, execution oriented, and reflect how work should be accomplished
- Changing the way resources are assigned to projects
- Determining how much WIP can be undertaken
- Training personnel to update their tasks daily
- Breaking the habit of multi-tasking
- Concentrating resources on the high priority task
- Customer awareness & buy-in of CCPM

Next Steps

- Improve project network modeling techniques
- Improve early project planning
- Focus on how to continue good resource concentration and flexibility
- Develop interfaces for external reporting
- Integrated CCPM into budget planning process

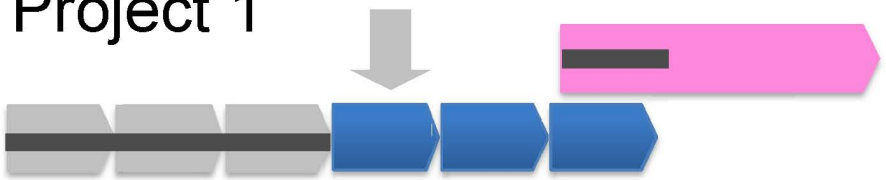
Conclusions

- Changing the way we do our work is critical for our future
- Results indicate that we can increase our project throughput with same resources
- Implementing CCPM has increased the need for horizontal integration across organization
- Cultural change is a challenge
- CCPM concepts may have broader applicability to other Dryden areas

END

Buffer signal used to synchronize and control

Project 1



Project Completion = 50%

Buffer Consumption = 40%

Project 2

Project Completion = 33%

Buffer Consumption = 50%

Project 2 is eating buffer at a faster rate = Higher priority